Proceedings V World Avocado Congress (Actas V Congreso Mundial del Aguacate) 2003. pp. 579-583.

EVALUATION OF ALTERNATIVE FUNGICIDES FOR CONTROL OF CERCOSPORA SPOT ON 'FUERTE'

A Willis and JA Duvenhage

Merensky Technological Services. P O Box 14. Duiwelskloof 0835. South Africa.
E-mail: anitaw@hansmerensky.co.za

ABSTRACT

Cercospora spot caused by *Pseudocercospora purpurea* is the most serious pre-harvest disease of avocado in South Africa. The disease is typically controlled by high volume copper sprays which may cause build up of copper in soils. Alternative chemicals were evaluated during the 1999/2000, 2000/1 and 2001/2 seasons for control of Cercospora spot and post harvest diseases with the aim to reduce or replace copper sprays. The experiments were carried out in a high disease pressure orchard at Westfalia Estate in Limpopo Province, South Africa. Results from the 1999/2000 and 2000/1 seasons indicated that azoxystrobin should be further evaluated in the 2001/2 season. Sulphur and chlorothalonil were evaluated for the first time, as well as other non-copper compounds mixed with lowered rates of copper oxychloride. Fruit of different treatments were evaluated for incidence of Cercospora spot, sooty blotch and visible spray residues in the orchard. A sample of fruit from each treatment was stored at 5.5°C for 28 days, and evaluated for post-harvest diseases and disorders after ripening at 20°C. In 2001/2, disease pressure was extremely high in the experimental orchard and 2 to 3 applications of copper oxychloride (3g/R) gave the best control of Cercospora spot. The lower rate of copper oxychloride (2g/R) combined with Ferric chloride gave fair results. Azoxystrobin and chlorothalonil yielded disappointing results for Cercospora spot control, however azoxystrobin did result in lower incidence of post harvest anthracnose than standard copper oxychloride.

Key Words: *Pseudocercospora purpurea*, Cercospora, pre-harvest disease, avocado, Fuerte, copper.

INTRODUCTION

Cercospora spot caused by *Pseudocercospora purpurea* is still the most serious pre-harvest disease of green skin avocados in South Africa. The disease is characterised by raised shiny black spots, 1-6mm in diameter in the early stages, with spots becoming sunken in later stages (Darvas, 1982). The most critical period for Cercospora spot infection on 'Fuerte' is early in the rainy season. Spore production of the pathogen is associated with rainfall and favourable warm temperatures (Darvas and Kotze, 1979). Cercospora spot is usually controlled by two to five high volume applications of copper fungicides during the rainy period (October to February) and Benomyl has often been included once per season. The presently growing need to reduce the amount of copper applied to orchards, is driven by export markets as well as the future sustainability of farming operations. Trials carried out during the 2000/1 season in a high disease pressure orchard on Westfalia Estate showed that certain products needed to be evaluated further. Treatment with copper oxychloride followed by lime sulphur, azoxystrobin, a *Bacillus* spp or *Bacillus subtillis* gave similar control. The *Bacillus* spp. and *Bacillus subtillis* are both natural antagonists, and as *Bacillus subtillis* (Avogreen®) is already a registered commercial product for Cercospora spot and anthracnose control in South Africa, neither was tested further. Of the strobilurins previously tested, azoxystrobin gave the best control of Cercospora spot and showed potential for anthracnose control, therefore it was evaluated further in the 2001/2 season (Duvenhage, 2002). Sulphur and chlorothalonil were evaluated for the first time in the 2001/2 season, as well as other non-copper compounds mixed with lowered rates of copper oxychloride. The aim of this project was therefore to test promising fungicides and new products as pre-harvest sprays for control of Cercospora spot and post-harvest diseases on 'Fuerte'.

MATERIALS AND METHODS

Chlorothalonil, azoxystrobin and sulphur were tested in comparison with standard copper oxychloride. Lowered rates of copper oxychloride were tested with various additives: Ferric chloride ($FeCl_3.6H_2O$,) chlorine dioxide and a quaternary ammonium compound (QAC) combination product. Ferric chloride has been used as an additive to lowered rates of copper oxychloride with good results for the control of bacterial black spot of mango (Manicom and Schoeman, 2001; Duvenhage *et al.,* 2001), therefore this treatment was evaluated on avocado in the 2001/ 2 season. Refer to Table 1 for treatment details.

The experiment was carried out at Westfalia Estate near Duiwelskloof in the Limpopo Province, South Africa. This region has a high potential for Cercospora spot infection due to the climate. Seven twenty -two-year old Fuerte trees were used for each treatment and treatments were applied by high volume spraying with handguns.

One hundred and forty fruit were randomly picked from each treatment and evaluated for incidence of Cercospora spot, sooty blotch and visible spray residues in the orchard during March 2002. A 0-3 scale was used for evaluations as follows:

Cercospora:	0= clean	1= 1-5 lesions	2= 6-10 lesions	3=>10 lesions
Sooty blotch:	0= clean	1= <20% fruit surf.	2= 21-50% fruit surf.	3=>50% fruit surf.
Spray residue:	0= clean	1= <20% fruit surf.	2= 21-50% fruit surf.	3=>50% fruit surf.

Two cartons of fruit (size 14 to 18) were sampled from each tree and stored at 5.5°C for 28 days to simulate shipment. Fruit were then ripened at 20°C and evaluated for post-harvest diseases and disorders upon ripening. A 0-3 scale was used for evaluations as follows:

Specific dis.: 0= clean 1= <20% fruit surf. 2= 21-50% fruit surf. 3= >50% fruit surf.

Statistical analysis of data was done using Tuckey's test at 95% significance level.

RESULTS AND DISCUSSION

There was extremely high disease pressure in the trial orchard probably due to a build up of inoculum in the trees over the past three seasons during which the orchard was used as a trial site. The untreated control had severe disease and no clean fruit at all. Two or three applications of Copper oxychloride gave the best control of Cercospora spot, and there was no significant difference between two or three copper oxychloride sprays. Treatment with azoxystrobin (4ml/10R) gave some disease control, though not significantly better than the untreated control and would probably be useful as a second spray following a copper spray. The lowered rate of copper oxychloride combined with Ferric chloride also gave some control and could be useful to further decrease copper levels applied to orchards. In comparison, the lowered rate of copper oxychloride combined with chlorine dioxide or QAC gave no significant control. Sulphur and chlorothalonil also gave disappointing results in this regard (Figure 1). Incidence of sooty blotch was low and no significant differences between treatments were observed. As could be expected, the copper oxychloride and sulphur containing products resulted in high incidence of visible spray residues, while the fruit from other treatments (azoxystrobin and chlorothalonil) were free of visible spray residues (Figure 2). Although no significant differences in the incidence of post harvest anthracnose were observed, standard copper oxychloride, lowered copper oxychloride with chlorine dioxide, and azoxystrobin treatments tended to result in lower incidence of anthracnose when compared to other treatments (Figure 3). There were no significant differences observed in the incidence of stem end rot, cold damage, vascular browning or other physiological disorders.

CONCLUSIONS

None of the products tested outperformed copper oxychloride (3g/R) for Cercospora spot control. However, azoxystrobin did reduce post harvest anthracnose more than any other product tested, although not significantly. Future trials will focus on low volume application techniques and low copper products, in order to reduce the amount of copper applied to orchards.

Acknowledgements

The authors wish to thank the South African Avocado Growers' Association for financial support and Westfalia Estate for the use of experimental orchards and funding. The technical assistance of Mr. H Mashele, Mr. T Mookamedi and Ms I Mashishi is much appreciated.

REFERENCES

DARVAS J M 1982. Etiology and control of some fruit diseases of avocado (*Persea americana* Mill) at Westfalia Estate, D SC-thesis, University of Pretoria, Pretoria, SA

DARVAS JM, KOTZE JM 1979. *Cercospora* spot of Avocados. South African Avocado Growers' Association Yearbook 3: 38-39

DUVENHAGE JA 2002. Evaluation of new generation fungicides for control of *Cercospora* spot on avocado fruit. South African Avocado Growers' Association Yearbook 25: 11-13

MANICOM B, SCHOEMAN M 2001. A simple, effective additive to copper oxychloride sprays to enhance the control of bacterial black spot of mango. South African Mango Growers' Association Yearbook 21: 22-24

Table 1. Treatments and dates of application

Treatment and date

2	November 2001	3 December 2001	8 January 2002
1	Untreated control	-	-
2	Copper oxychloride (3g/P)	-	Copper oxychloride 3g/P)
3	Copper oxychloride (3g/P)	Copper oxychloride (3g/-P)	Copper oxychloride (3g/P)
4	Azoxystrobin 250SC (3ml/10P)	Azoxystrobin 250SC (3ml/10P)	Azoxystrobin 250SC (3ml/10P)
5	Azoxystrobin 250SC (4ml/10P)	Azoxystrobin 250SC (4ml/10P)	Azoxystrobin 250SC (4ml/10P)
6	Sulphur (3g/P)	Sulphur (3g/P)	Sulphur (3g/P)
7	Sulphur (5g/P)	Sulphur (5g/P)	Sulphur (5g/P)
8	Chlorothalonil 500SC (3ml/P)	Chlorothalonil 500SC (3ml/P)	Chlorothalonil 500SC (3ml/P)
9	Copper oxychloride (2g/P) + Buffer to pH6 + $FeCl_3.6H_2O$ (5g/100P)	-	Copper oxychloride (2g/P) + Buffer to pH6 + $FeCl_3.6H_2O$ (5g/100P)
10	Copper oxychloride (2g/P) + Chlorine dioxide(1ml/P)+ Wetter (2ml/10P)	-	Copper oxychloride (2g/P) + Chlorine dioxide(1ml/P) + Wetter (2ml/10P)
11	Copper oxychloride (2g/P) + QAC (1ml/P)	-	Copper oxychloride (2g/P) + QAC (1ml/P)

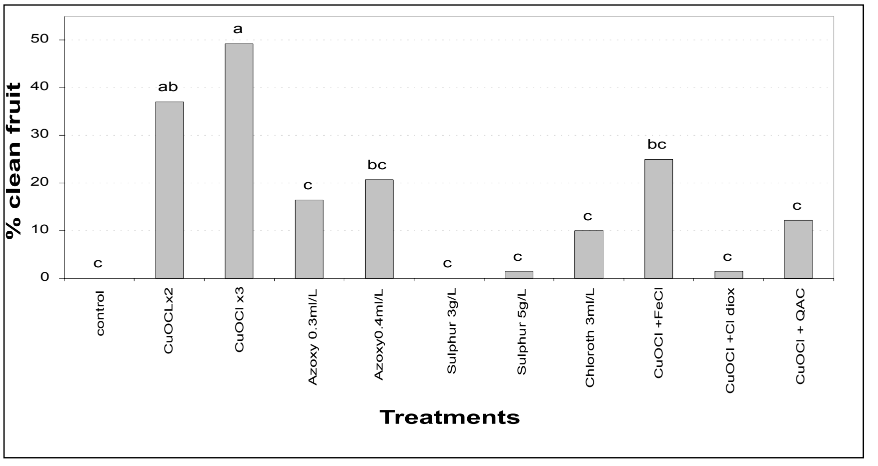

Figure 1: Percentage clean fruit: Cercospora spot 2002

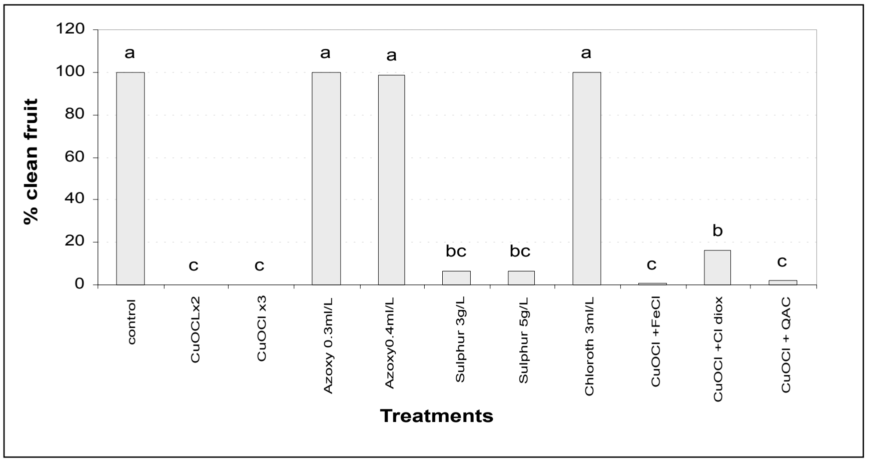

Figure 2: Percentage clean fruit: Visible spray residues 2002

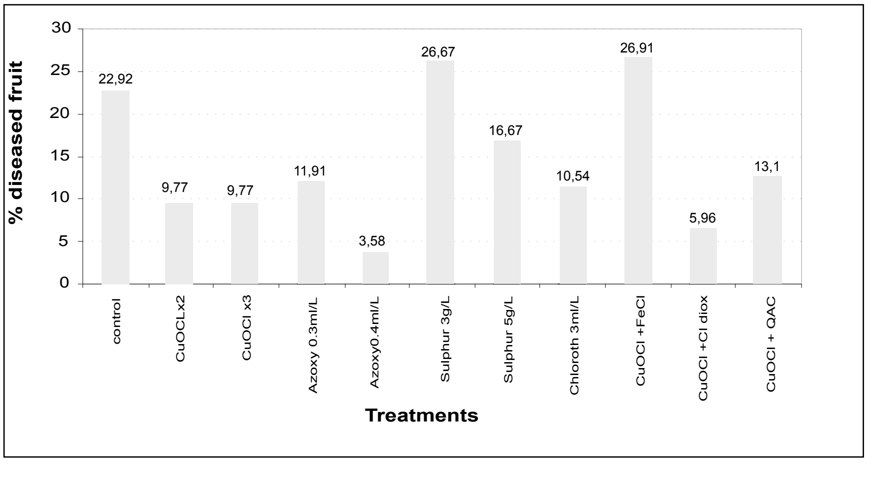

Figure 3: Incidence of post-harvest Anthracnose 2002.